FAA-E-2403a
March 24, 1971
SUPERSEDING
FAA-2403, 8/21/69

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION SPECIFICATION

RUNWAY VISUAL RANGE REMOTE DISPLAY PANEL UTILIZING

ELECTRONIC READOUT

1. SCOPE

1.1 Scope.- This specification delineates the requirements for a Runway Visual Range (RVR) Remote Display Panel utilizing electronic readout. The panel operates with an RVR Signal Data Converter and receives the necessary signal over a two wire telephone line presenting a readout of the RVR value as a digital display on the face of a vacuum tube or on a similar non-mechanical display. The type of equipment defines the type of Signal Data Converter with which the panel shall operate. Two types apply as follows:

1.2 Type I.- Type I panel shall operate with RVR signal data converters in use by the FAA and manufactured by Industrial Research Associates, Baltimore, Maryland 21228.

1.2.1 Type II.- Type II panel shall operate with RVR signal data converters Type FA-7871 in use by the FAA and manufactured by Solid State Radiations Incorporated, Log Angeles, California.

2. APPLICABLE DOCUMENTS

2.1 FAA specifications.- The following FAA specifications, of the issues specified in the invitation for bids or request for proposals, form a part of this specification:

FAA-G-2100/1	Electronic Equipment, General Requirements; Part 1 General Requirements for all Equipments
FAA-G-2100/3	Requirements for Equipments Employing Semi-Conductors
FAA-G-2100/4	Requirements for Equipments Employing Printed Wiring Techniques
FAA-G-2100/5	Requirements for Equipments Employing Micro-electronic Devices
FAA-D-638	Instruction Books, Electronic Equipment

2.2 Military and Federal publications.- The following Military and Federal publications, of the issues in effect on the date of the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

2.2.1 Military standards

MIL-STD-806	Graphic Symbols for Logic Diagrams
MS-33558	Standard Form of Numerals and Letters Aircraft Instrument Dial
MIL-STD-129	Marking for Shipment and Storage

2.2.2 Military specification

MIL-E-17555	Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of

2.2.3 Federal standard

Fed. STD. 102	Preservation, Packaging and Packing Levels

(Copies of this specification and other applicable FAA specifications, standards and drawings may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids or request for proposals. Requests should fully identify material desired, i.e., specification, standard, amendment, and drawing numbers and dates. Requests should cite the invitation for bids, request for proposals, or the contract involved or other use to be made of the requested material.)

(Copies of Military specifications and standards may be obtained by mailing requests directly to the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania, 19120.)

(Information on obtaining copies of Federal standards may be obtained from General Services Administration offices in Atlanta; Auburn, Washington; Boston; Chicago; Denver; Fort Worth; Kansas City, Mo.; Los Angeles; New Orleans; New York; San Francisco; and Washington, D.C.)

3. REQUIREMENTS

3.1 General.- Each equipment furnished by the contractor shall be complete in accordance with all specification requirements and shall include:

1 ea. RVR Remote Display Panel

1 ea. 6 foot line cord

4 sets Runway Identification Decals (see 3.13)

2 ea. instruction books in accordance with FAA-D-638 Logic diagrams contained therein shall be in accord with MIL-STD-806.

Additional instruction books shall be supplied as required by the contract document.

In the event that the equipment specified herein is supplied as an item of an RVR Signal Data Converter System, a separate instruction book shall not be supplied if the instructional material is included in the instruction book covering the entire system.

3.2 Service conditions.- Equipment supplied under this specification shall operate from a single phase two wire AC line having a standard design-center values of 120 volts, 60 Hz (see FAA-G-2100/1, 1-3.2.23). The equipment shall operate under any combination of voltage and frequency specified by these design-center values.

3.3 Ambient conditions.- The equipment shall operate and meet all specification requirements under ambient conditions of Environment I (see FAA-G-2100/1, 1-3.2.23).

3.4 Reliability.- The reliability of the equipment shall be such that it will assure a Mean Time Between Failure (MTBF) of 20,000 hours. The contractor shall demonstrate by a theoretical analysis that the equipment satisfies this requirement.

3.5 Mean time to repair.- The mean time to repair the equipment specified herein after failure of any part shall not exceed 30 minutes from the time the equipment is removed from its operating location to the time it is restored to its operation location. Typical failures shall be simulated and replacement made to demonstrate compliance with this requirement.

3.6 Semiconductor devices.- The use of semiconductors in accordance with FAA-G-2100/3 is required unless space and design considerations dictate the use of integrated circuitry (see 3.8).

3.7 Printed wiring.- The use of printed wiring in accordance with FAA-G-2100/4 is required (see 3.8).

3.8 Microelectronic devices.- The use of microelectronic devices in accordance with FAA-G-2100/5 is required where equipment design or reliability make this desirable.

3.9 Panel compatibility.- Type I Runway Visual Range Remote Display Panel shall operate from information provided by the Signal Data Converter, a part of the Runway Visual Range System, as manufactured by Industrial Research Associates. Type II Runway Visual Range Remote Display Panel shall operate from information provided by the Signal Data Converter, Type FA-7871. No modification is to be applied to the Signal Data Converter to permit operation of the display panel, with the exception of any required modification to permit instantaneous update after selection, and a modification to provide encoding of light information. Any required modification to the signal data converter shall consist of plug-in units to permit rapid field modification. Minimal wiring changes will be permitted if the contractor demonstrates the need and desirability thereof. The contractor shall obtain or arrange for the use of the necessary Signal Data Converters too determine signal output characteristics and demonstrate compatibility of equipment. The Signal Data Converter System is not a deliverable item to the government under this specification.

3.9.1 Modification Kit for Signal Data Converter.- The contractor shall supply any required modification kit to permit instantaneous update of RVR information after selection and to provide encoding of light information. See 3.9 and 3.21 hereof. The modification kit shall consist of the required circuitry mounted on one card, prewired with necessary connectors, wiring and terminations to permit rapid installation at field locations by FAA technical personnel. Each modification kit shall be provided with complete installation instruction, in addition one camera copy shall be furnished for the addenda to existing instruction books by the government. These instructions shall update the existing instruction book in each section relating to the theory, operation, supply support and maintenance of the equipment employing modification. Each modification kit shall be appropriately marked as for its use with the Signal Data Converter manufactured by Industrial Research Associates or for use with Type FA-7871 Signal Data Converter.

3.10 Panel size.- The Remote Display Panel size shall be 7 inches by 10 inches. Mounting holes shall be symmetrically located at the corners of the panel to permit secure surface mounting to a controller's desk provided with an opening of 5 7/8 inches by 9 1/8 inches. Mounting holes shall be 0.196 inch $\pm$ .002 inch and countersunk 0.37 inch diameter. The depth of the chassis behind the panel, including mating connectors and cable clearance shall not exceed 9 1/2 inches. No component attached to the chassis shall protrude more than 9 inches from the back of the panel. Mounting holes and clearances shall be identical to Type FA-7875, Remote Display Panel, to permit interchangeability of panels.

3.10.1 Panel construction.- Panel construction, finish and marking shall be in accordance with FAA-G-2100/1.

3.10.2 Chassis construction.- Chassis construction, (mechanical and electrical) finish, and marking shall be in accordance with FAA-G-2100/1.

3.11 Panel layout.- The general configuration of the remote display panel shall be that as shown in Figure 1. The panel shall display three RVR readouts. Associated with each readout shall be a runway select switch, an alarm setting device, an alarm light, and an aural alarm. Five miniature lights shall be associated with each readout to indicate the operating mode of the signal data converter, i.e., D, N, 3, 4, 5.

3.12 RVR readout.- The runway visual range readout shall be an electronic readout, projection type unit, light emitting diode or a similar non-mechanical display meeting the performance characteristics of this specification. Character size shall be 5/16 inch high by 1/4 inch wide. Approval of the government shall be obtained before the readout panel design is finalized. Readouts shall be designed for removal from the front of the panel for ease of maintenance.

3.12.1 Digit presentation.- The RVR readout shall be made up of three digits or alpha-numerics having characters displayed as follows:

1st digit: blank, 1, 2, 3, 4, 5, 6

2nd digit: blank, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

3rd digit: blank, E, L, T, -, +, -T, +T

3.12.2 Intensity of readout.- The RVR readout display shall be capable of being viewed without "washout" at a distance of twelve feet under ambient illumination conditions ranging from darkness to 4,000 foot candles. For demonstration compliance with this requirement of maximum illumination conditions the viewing angle shall be normal to the display.

3.12.3 Viewing angle.- The viewing angle shall be 45° either side of center, horizontally and vertically, at a distance of 12 feet. Viewing surface shall be as close to the panel surface as possible.

3.13 Runway select switch.- A runway select switch shall be provided with each RVR display to permit selection of any one of ten signal data converters. The runway select switch shall be a thumbwheel type unit having 10 steps. Character size shall be a nominal 1/4 inch high by 1/8 inch wide. White figures shall be displayed on a black background. Up to three digits shall be displayed on each position (e.g., 24L, 24R, 27, 03). Four sets (one of each readout plus a spare) of decals shall be provided with each panel to permit identification of selected runway on each select switch. Each decal set shall include the digits 01 to 36 inclusive, 01L to 36L inclusive and 01R to 36R inclusive. At the option of the government, the contractor shall supply switches with engraved markings if runway designations are available. Switch dials shall be provided with a variable light intensity illuminations.

3.14 Alarm system.- An alarm system shall be provided which shall indicate whenever the RVR reading is equal to or below a specified or predetermined value. If the RVR falls on or below this value an alarm bell shall ring with one long chime and a telltale lamp shall light. The bell shall ring every time a reading is updated and the value remains at or below the preselected value. If the RVR goes above the preset limit, the lamp shall extinguish. The preset value may be any displayed RVR reading. There shall be an alarm associated with each RVR readout on the panel.

3.14.1 Alarm setting switch.- The alarm setting switches (marked alarm setting) shall be a thumbwheel type unit having ten steps. The first switch shall have the following positions: 0, 10, 20, 30, 40, 50, 60; the second shall have the positions 0 to 9. All values are expressed in hundreds of feet. This combination shall permit the alarm to activate when the visibility reaches any present position from 600 feet to 6,000 feet. The alarm value shall be obtained by summing the values of the two switches. An "off" position shall make the alarm inoperative. At the option of the contractor, the position 0-0 may be used as an "off" position. Each display alarm shall be independent of all other systems. Thus, the three alarm systems on the panel may be set at three different values or may be turned off, if desired.

3.14.1.1 Alarm marking characteristics.- The alarm setting switch shall be provided with figures as designated in 3.14.1 having a nominal size of 1/4 inch high by 1/8 inch wide. White figures shall be engraved on a black background. Switch dials shall be provided with a variable light intensity illumination.

3.15 Alarm light.- The alarm light associated with each alarm setting switch (3.14) shall be a miniature lamp of fixed intensity (see 3.18). The lamp shall be provided with a red jewel.

3.16 Aural alarm.- The alarm associated with the alarm setting switch (3.14) shall provide a distinctive bell-like sound such as that provided by Wheelock Signal Single Stroke Bell No. 62-01-C2AJ or equal, capable of operation in any position when mounted in the cabinet at any angle from 30° to 90° from the horizontal.

3.17 Operating mode indication.- Five miniature lamps shall be associated with each RVR readout to provide an indication of the operating mode of the selected signal data converter. Two lamps shall be used to indicate whether the system is operating in a day or night mode. Those lamps shall be used to indicate the light setting (3, 4 or 5) on which RVR readings are being computed. An illuminated lamp will indicate the existing operating mode. Panel or jewels will be appropriately marked D, N, 3, 4 and 5. The lamps shall be provided with jewels as follows: D white jewel; N blue jewel; 3, 4, 5 yellow jewel.

3.18 Panel illumination.- The intensity of the RVR readout shall be variable from maximum intensity to extinction. The extinction position shall be at the extreme counterclockwise position of the control. The operating mode indication lamps shall be illuminated at approximately half intensity of the RVR readout. The intensity level of the operating mode indication lamps shall be adjustable by an internal potentiometer to any desired intensity level below that of the RVR readout and then controlled by the same adjustment that controls the RVR readout intensity. The alarm lamp intensity shall be fixed at a level which is less than that of the RVR readout, but higher than that of the operating mode indication lamps.

3.19 Operating controls.- In addition to the controls specified above (runway select switches and alarm setting switch) the following controls shall be provided. One master dimming control shall be furnished to provide the functions described in 3.13, 3.14.1.1, and 3.18 above. An off-on, or "push-to-on" power switch shall be provided. A high reliability switch, with built-in fuse, may be used in lieu of one required by Specification FAA-G-2100/1 with the approval of the government. Fuse replacement shall be accomplished from the front of the panel.

3.20 Input to panel.- Up to ten input signals, each signal utilizing two wires may be connected to the panel. The panel shall be capable of accepting either of two input levels; +5 V or -12 V. Signals to the panel will be transmitted via two wire communication wire unbalanced, up to 25 miles distant with a terminal impedance of 600 ohms $\pm$ 10%.

3.21 Selection capability.- Each display of the panel shall select any one of ten input signals (RVR value and operating mode) for display on the panel readout and operating mode indication shall be displayed within 3 1/4 to 4 seconds after selection. A 1/10th second delay shall be included to prevent update of display when selector is turned through a runway selection position.

3.21.1 Multiple selection capability.- Each remote display panel shall select any one of ten signal data converters (3.21) and do so independently of any selection made from any other display panel in the system. As an illustration, any one of ten operators may select any one of ten signal data converters and receive the desired RVR reading, operating mode, and alarm information. Likewise, any two or all operators may select the same signal data converter, simultaneously or consecutively without any derogation of performance.

3.22 Additional output (optional).- An output connection shall be provided to permit connection of a repeater (slave) unit which will simultaneously display that information which is displayed on the remote display panel. Each repeater display will have three RVR indicators, three alarm lamps and an alarm tone, but no selection controls. The remote display panel shall have provision for addition of a plug-in module which will provide the required retransmit function to the slave unit, and may be inserted, without any wiring change at those locations where a repeater unit is utilized. This plug-in module will not be supplied unless specified in the contract document. The remote display panel shall drive up to ten repeater units.

3.23 Input and output termination.- Input and output terminations shall be screw terminals of the type required by FAA-G-2100/1. Parallel connection of remote display panels shall be supplemental terminal blocks, see Figure 2. Terminal blocks are not a required end item of this contract. Installation instructions shall recommend terminal blocks by manufacturer and type number that may be suitable for installing a system, Type CFG material is permissably for this usage under MIL-M-14 (1-3.15.3, FAA-G-2100/1).

3.24 Failsafe.- If the display panel fails to receive a transmission from the signal data converter, an error indication shall appear on the display readout.

3.25 Nameplates.- In lieu of a nameplate located on the front panel, the nameplate shall be suitably positioned on an easily observed location behind the panel.

4. QUALITY ASSURANCE PROVISIONS

4.1 General.- Quality assurance provisions shall be in accordance with FAA-G-2100/1. Tests apply to remote display panel and slave unit as applicable. Four classes of tests are required as indicated below:

4.2 Contractor's preliminary tests.- The contractor shall perform in accordance with the requirements of FAA-G-2100/1, paragraph 1-4.3.1 et seq.

4.3 Design qualification tests.- The contract shall perform in accordance with the requirements of FAA-G-2100/1, paragraph 1-4.3.2 et seq. The contractor shall also perform the following tests as a part of the design qualification tests.

4.3.1 Reliability.- The contractor shall submit a theoretical analysis or demonstrate compliance with this requirement (3.4).

4.3.2 Mean time to repair.- Typical failures shall be simulated and replacement made to demonstrate compliance with this requirement (3.5).

4.3.3 Panel size.- Physical interchangeability shall be demonstrated (3.10).

4.3.4 Design requirements.- Compliance with the following design requirements of the specification shall be demonstrated. Panel compatibility (3.9), Panel construction (3.10.1, 3.10.2), Panel layout (3.11), RVR readout (3.12, 3.12.1, 3.12.2, 3.12.3), Runway select switch (3.13), Alarm system (3.14, 3.14.1, 3.14.1.1), Alarm light (3.15), Aural alarm (3.16), Operating mode indication (3.17), Panel illumination (3.18), Operating controls (3.19), Input (3.20), Selection capability (3.21, 3.21.1), Output (3.22), Terminations (3.23), Failsafe (3.24); Nameplate (3.25).

4.4 Type tests - normal test conditions.- Utilizing the procedure establish in FAA-G-2100/1, paragraph 1-4.3.3 et seq. The following type tests shall be conducted under normal test conditions.

4.4.1 Panel compatibility.- The remote display panel shall be connected to a Type FA-7871 signal data converter which is provided with a Type FA-7875 remote display panel. The Type FA-7871 signal data converter test function shall be initiated to provide all possible readouts. Readouts of the two panels shall be in agreement. Each RVR readout shall be so tested. A similar test shall be conducted for the Type I panel with its associated Signal Data Converter and Remote Display Panel.

4.4.2 Intensity of readout.- (3.12.2). The contractor shall demonstrate that the readout is capable of being viewed without "washout."

4.4.3 Runway select switch.- (3.13). The contractor shall demonstrate that each runway select switch selects any one of ten signal data converters.

4.4.4 Alarm system.- (3.14, 3.15, 3.16). The contractor shall demonstrate that the alarm system properly alarms at each and every setting.

4.4.5 Operating mode.- (3.17). The contractor shall vary the operating mode on the signal data converter and demonstrate that the display panel is in correspondence.

4.4.6 Panel illumination.- (3.18). Variation of illumination shall be demonstrated.

4.4.7 Selection capability.- (3.21). Update and delay times shall be demonstrated for each RVR readout, and at different times in the signal data converter update cycle. Multiple selection capability shall be demonstrated (3.21.1).

4.4.8 System test.- Ten remote display panels shall be connected to one signal data converter. Ten slave units (when ordered) shall be connected to one of the remote display panels. Test required by 4.4.1 above shall be conducted. All RVR values shall be in agreement. This test shall be conducted with a telephone line of 50 feet, 5 miles (simulated) and 25 miles (simulated) connecting the signal data converter and remote display panels. Similar cabling shall be utilized between the remote display panel and the ten slave units.

4.4.9 Failsafe.- Signal failure shall be simulated to demonstrate error indication.

4.5 Type tests - service conditions.- The following test is to be conducted under service conditions.

4.5.1 Panel compatibility.- Refer to 4.4.1 above.

4.6 Type tests - normal test conditions except voltage and frequency.- The following tests are to be conducted under normal test conditions with the exception that tests shall be conducted under the upper and lower extreme conditions of voltage and frequency and combinations thereof.

4.6.1 Panel compatibility.- Refer to 4.4.1 above.

4.6.2 Runway select switch.- Refer to 4.4.3 above.

4.6.3 Alarm system.- Refer to 4.4.4 above.

4.6.4 Operating mode.- Refer to 4.4.5 above.

4.6.5 Failsafe.- Refer to 4.4.9 above.

4.7 Production tests.- The following production tests are to be conducted on each assembled unit.

4.7.1 RVR readout.- Each readout shall be checked to determine that each digit or display responds properly to this initiating signal.

4.7.2 Selection capability.- An input incorporating RVR readout and operating mode shall be applied to each input, and selection made to determine that selection circuitry operates correctly.

4.7.3 Alarm circuitry.- Alarm circuitry shall be checked for three RVR values.

4.7.4 Overall check.- A check shall be made of all controls, switches, and construction details to assure compliance with applicable specifications.

5. PREPARATION FOR DELIVERY

5.1 General.- Preservation, packaging, packing and marking shall be in accordance with the requirements of Specification MIL-E-17555. Levels of protection as defined in Fed. STD. 102 shall be as specified by the procuring activity (see 6.2).

5.2 Preservation/packaging.- Each RVR remote display panel, complete with accessories and instruction books (see paragraph 3.1), shall be individually preserved and packaged in accordance with the Level A or C requirements of Specification MIL-E-17555 (see 6.2).

5.3 Packing.- Items preserved and packaged as above, shall be packed in exterior type containers, selected from appropriate Tables of MIL-E-17555, conforming to the applicable levels of packing specified (see 6.2).

6. NOTES

6.1 Note on information items.- The paragraphs below are only for the information of the Contracting Officer and the Requisitioning Office intended to assist in formulating a contract. They are not contract requirements, nor binding on either the government or the contractor except to the extent that they may be specified in the contract as such. Any reliance placed by the contractor on the information in these subparagraphs is wholly at the contractor's own risk.

6.1.1 Application.- This amendment is to be applied when it is desired to procure the panel specified herein as replacement for, or to augment, existing digital readout panels which are a part of RVR systems made by Industrial Research Associates or Solid State Radiations Incorporated. The following determinations are to be made in preparation of the contract document.

6.1.1.1 Types to be procured.- Type I panels can be used only with IRA equipment. Type II panels can be used only with SSR equipment. The required quantities of each type shall be determined.

6.1.1.2 Modification kits.- One Type I modification kit will be required for use with each IRA Signal Data Converter which provides a signal to the readout panel. One Type II modification kit will be required for use with each SSR Signal Data Converter which provides a signal to the readout panel.

6.1.1.3 Retransmit module.- No requirement exists for this unit in present FAA applications.

6.1.1.4 Ancillary equipment requirements.- Use of this panel deletes any requirement for receiver decoder or computer selector used with present systems. It further permits utilization of ten signal converters with each display panel in lieu of eight or four as permitted by present systems.

6.1.1.5 Runway select switch.- Note that at the option of the government the contractor shall supply switches with markings applied by a hot stamping process. At time of request for procurement, a statement should be included for information as to the procedure the supplier will follow to assure that selector dials are provided with permanent runway designations as applicable to the airport at which the panels are to be used.

6.2 Ordering data.- Procurement documents shall specify the following:

(a) Title, number and date of this specification.
(b) Levels of preservation, packaging and packing (see 5.2 and 5.3).

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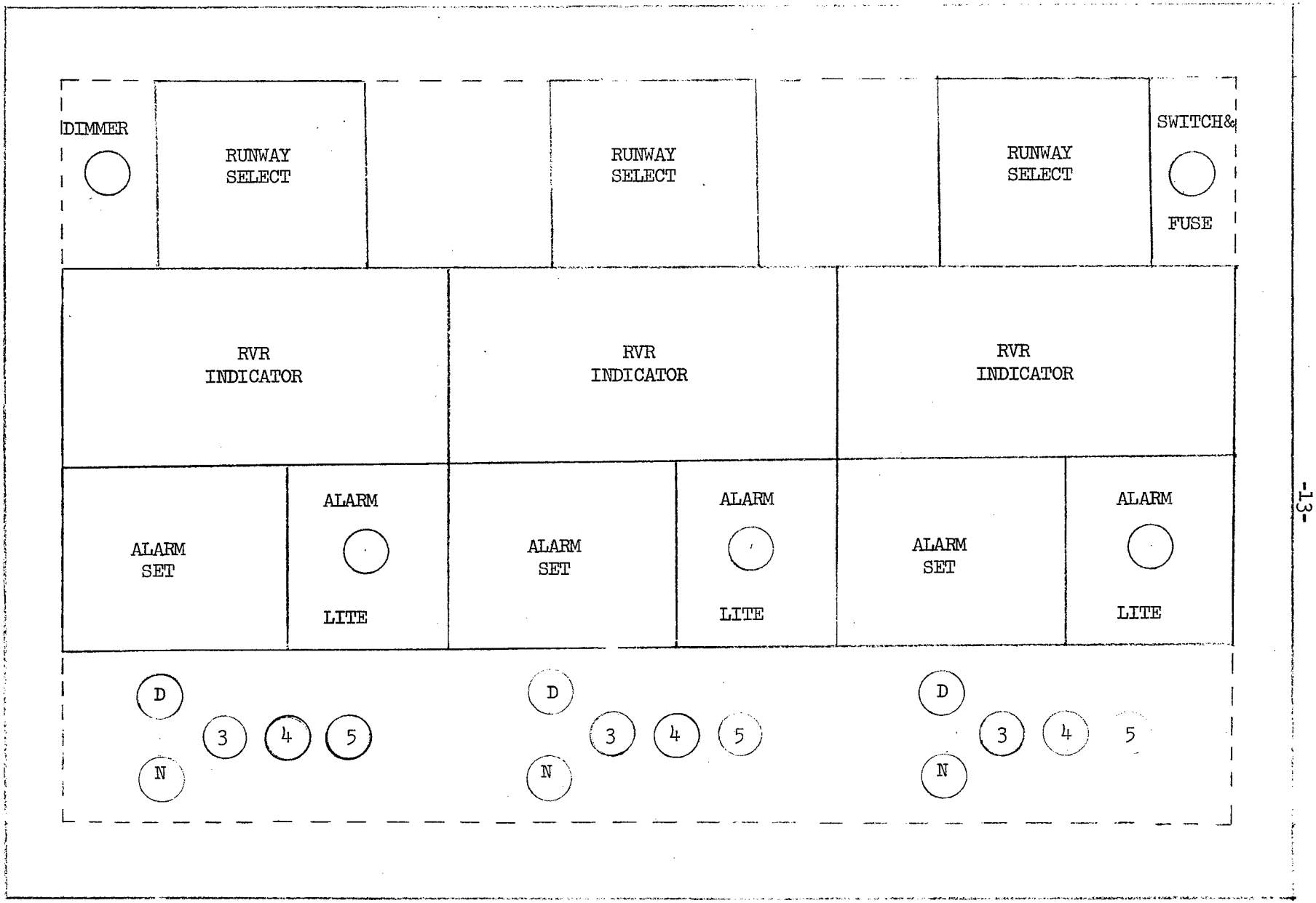
FOR FIGURES 1 AND 2, SEE PAGES 13 and 14.


DIMMER
RUNWAY SELECT
RUNWAY SELECT
RUNWAY SELECT
SWITCH&
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RVR INDICATOR
RVR INDICATOR
RVR INDICATOR
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FIGURE 1

Typical Display Layout

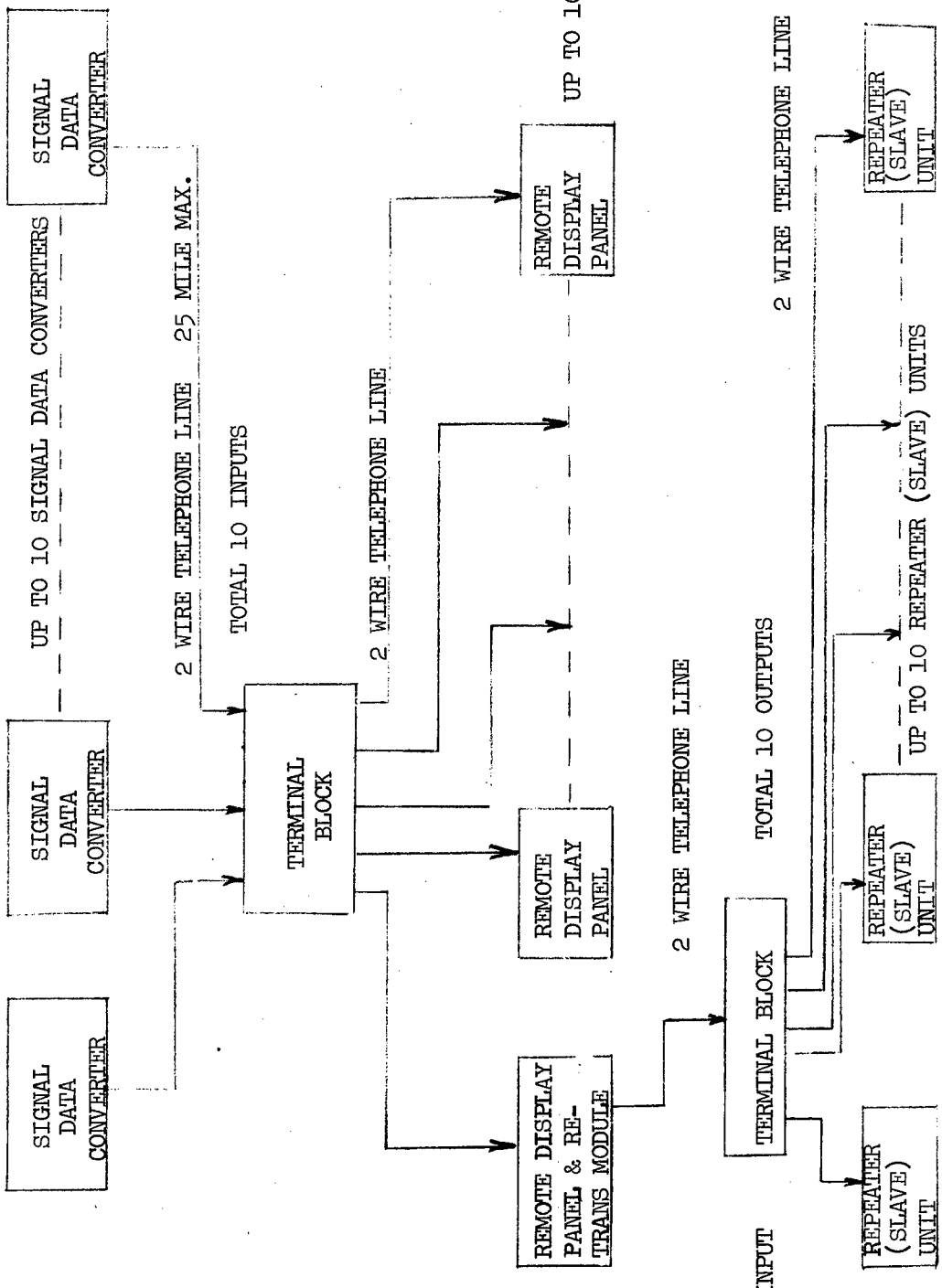

FIGURE 2

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